

Laparoscopic Appendectomy in Children

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ABSTRACT

Background and Objectives: The advantages of laparoscopic appendectomy over open appendectomy have not yet been clearly demonstrated. The present study evaluated our early experience with laparoscopic appendectomy in children, in terms of its safety, effectiveness, technical difficulties, and economics.

Methods: We reviewed the records of 50 cases involving laparoscopic appendectomy performed at our affiliated institutions between September, 1994, and September, 1996. Patient age ranged from 6 to 18 years (mean, 14 years). Thirty-two patients had acute nonperforated appendicitis, six had perforated appendicitis, two had fibrosis of the appendix, and ten had a histologically normal appendix.

Results: In five patients the laparoscopic procedures were converted to open appendectomies because of technical difficulties. There were postoperative complications in four patients: one incomplete appendectomy which subsequently required an open appendectomy for completion, one pelvic abscess, one bowel obstruction, and one minor wound infection.

Conclusions: Laparoscopic appendectomy is a safe and effective procedure. It takes longer operative time than open appendectomy. Length of hospitalization and incidence of postoperative complications are equivalent to those of open appendectomy. Economic benefits are difficult to assess at present. In sum, we believe that with better training, surgical techniques and equipment, laparoscopic appendectomy will eventually become the surgical procedure of choice in appendicitis.

Key Words: Adolescence, Child, Appendectomy, Laparoscopy

INTRODUCTION

Laparoscopic techniques have advanced greatly in the past few years. Currently, while laparoscopic cholecystectomy is the procedure of choice to remove the gallbladder, laparoscopic appendectomy has had a lower acceptance by surgeons, perhaps because the experience with this technique is limited and its advantage over the traditional open appendectomy have not been established.¹⁻⁵ While our European colleagues have had a significant experience with laparoscopic appendectomy even among children,⁶ in our country significant controversy still exists over the use of this surgical technique.^{1,2,5} The purpose of the present study was to review our early experience with laparoscopic appendectomy in children, in order to assess its safety, outcomes, technical difficulties, and cost.

PATIENTS AND METHODS

The first 50 cases of laparoscopic appendectomy in children, performed at our affiliated institutions between September, 1994, and September, 1996, were reviewed. Patient age ranged from 6 to 18 years (mean, 14 years). There were 32 males and 18 females. Thirty-two patients had acute nonperforated appendicitis, six had perforated appendicitis, two had fibrosis of the appendix, and ten had a histologically normal appendix. Incidental findings during appendectomy included inguinal hernias in three patients, Crohn's disease in two patients, bilateral obturator hernia in one patient, and Meckel's diverticulum in one patient. The Meckel's diverticulum was removed laparoscopically during the same operation.

In the 10 patients with histologically normal appendices, four patients had an incidental appendectomy during laparoscopic cholecystectomy, and another patient had an interval appendectomy following percutaneous catheter drainage guided by computerized tomographic scan. Thus, only five patients with a normal appendix had the clinical diagnosis of acute appendicitis for which they underwent laparoscopic appendectomy.

Operative Technique:

In all cases, laparoscopic appendectomy was performed using general endotracheal anesthesia with the patient in the supine position. The abdomen was entered with the

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Veress needle through an infraumbilical approach and a pneumoperitoneum was created with carbon dioxide to a pressure of 12 mm Hg. A three-trocar technique was used, with two 5 mm trocars and one 12 mm trocar for the introduction of the stapling device (Endo-GIA, United States Surgical Corporation, Norwalk, CT). The mesoappendix was divided between applied clips. After the appendix was freed, the appendiceal base was divided with the stapling device. The appendix was immediately placed in an endoretrieval bag and promptly removed to avoid contamination. The peritoneal cavity was irrigated in all four corners with normal saline solution containing antibiotic. The fascia of the 12 mm port was closed with 0 Polyglactin 910 suture; the fascia of the 5 mm ports was not closed. Skin was closed with subcuticular absorbable suture and Steri-Strips.

RESULTS

The 50 cases reviewed included five in which the laparoscopic procedures were converted to open appendectomy. Two patients had perforated appendicitis, and the risk of contamination with the laparoscopic technique was deemed too high. Three patients had an appendix that could not be safely dissected free from adhesions. In all five of these patients, the appendectomy was uneventfully completed using the open technique.

There was a postoperative complication in four patients among the remaining 45 patients who underwent laparoscopic appendectomy: one patient had an incomplete appendectomy and subsequently required an open completion appendectomy, with inversion of the appendiceal stump; one patient had a postoperative small bowel obstruction, which was treated successfully with laparoscopic lysis of adhesions; one patient had a postoperative pelvic abscess, which was successfully treated by percutaneous ultrasound-guided drainage; and one patient had a minor wound infection. The remaining 41 patients had successfully completed laparoscopic appendectomy with no complications. No mortality occurred in any of the total number of cases reviewed.

Average operative time for laparoscopic appendectomy was 110 minutes. The average time for open appendectomy, performed by the two trained pediatric surgeons (GS and JLZ), whose results are included in the present study, is 70 minutes. The average hospital stay was 5.4 days for patients (n=50) who had a laparoscopic appendectomy, compared with the previously reported 5.3 days for patients (n=414) who had an open appendectomy.⁷

The cost of the laparoscopic procedure was difficult to assess because this was a retrospective study. In the oper-

ating room disposable equipment was used in some cases, while in others it was not. There was no exact record of the specific kind of equipment used, other than the stapling device, which was standard for all cases. Concerning the cost of hospitalization, since the lengths of hospitalization were almost the same, there was no substantial difference.

Cost could not be compared to reimbursement, since diagnosis-related group coverage varied from \$4,187 to \$10,593, with no distinction for reimbursement between open and laparoscopic appendectomy. The anesthesia charges were also not substantially different between the charges for patients in the present study and those previously described.⁷ No significant conclusions concerning cost analysis could be drawn because of the limited size of our study group.

DISCUSSION

The advantages of laparoscopic appendectomy over open appendectomy have not yet been demonstrated.^{1,2,5,8} Open appendectomy is generally preferred by most surgeons because they are more familiar with this technique, and it generally can be performed quickly and safely. Unlike laparoscopic cholecystectomy, which has become the procedure of choice for gallbladder removal, laparoscopic appendectomy does not receive much demand for its use from patients, referring physicians or health organizations. The lack of demand for laparoscopic appendectomy may be due to its poorly defined advantages in terms of cost, hospitalization, and recovery/return-to-work time. In addition, the postoperative pain associated with it and the cosmetic results achieved by it, compared with open appendectomy, are still not well defined and remain controversial.^{1,2,5,9}

The safety of laparoscopic appendectomy has been well documented.^{3,5,6,8,9} In our series of patients, no mortality and no significant operative complications occurred. There were only four postoperative complications, related more to the disease than to the operative technique. We could not compare postoperative pain in laparoscopic appendectomy versus open appendectomy. Some authors report no advantage of laparoscopic appendectomy over the open technique with regard to postoperative pain or recovery in children.¹⁰

In our experience, laparoscopic appendectomy takes an average of 110 minutes to perform. In the literature, the average time for its performance in adult patients varies from 37 minutes to 110 minutes,⁹ and in a recent report of its use in pediatric patients (n=200), the average for its performance is 40 minutes.⁶ However, the operative time for laparoscopic appendectomy has been reported to be as

low as 20 minutes by authors who emphasize that their improved time is the result of their gaining more experience and better technical skills.¹¹ Our longer operating time may be due to the fact that since we work in a teaching institution, the procedure is performed by a senior surgical resident guided by an experienced attending laparoscopist.

In the present study, the length of hospitalization for laparoscopic appendectomy was equivalent to that of open appendectomy (5.4 versus 5.3 days, respectively).⁷ This finding is consistent with comparative studies in the literature.^{1,2,5,6} At the same time, we are now more confident to send patients home earlier, as we have gained more experience with the laparoscopic procedure, and thus we anticipate a reduced hospital stay.

Cost was difficult to evaluate because of the limitations of this retrospective study. The cost of laparoscopic appendectomy has been reported by some authors to be significantly higher than that of open appendectomy,^{1,4} while other authors have reported that the cost was not different between the two procedures.⁵

Based on our experience, we currently recommend laparoscopic appendectomy in children with the clinical diagnosis of acute nonperforated appendicitis, interval appendectomy, incidental appendectomy during other laparoscopic procedures, and during diagnostic laparoscopy for abdominal pain of uncertain etiology. Open appendectomy is recommended for children with obvious perforated appendicitis with peritonitis, and those with a palpable appendiceal mass. Parental preference for the standard open technique may also be a decisive consideration when choosing procedure.

CONCLUSIONS

Analysis of our early experience with laparoscopic appendectomy in children leads us to conclude that it is a safe procedure which provides therapeutic results comparable to those of open appendectomy. Although our experience with the laparoscopic procedure is limited, we are encouraged to continue to perform laparoscopic appendectomy. We agree with other authors^{3,6,9} that with better training, improved surgical technique and refinement of equipment, laparoscopic appendectomy will eventually become the surgical procedure of choice in appendicitis.

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